

REMARKS

Claims 20-46 are pending. By this Amendment, no claims are cancelled, claims 20 and 32 are amended and no new claims are added.

Objections to the Specification, Drawings and Telephone Interview

The Office Action objected to the specification indicating that the details of Figures 5 through 13 were not disclosed. In a telephone interview with the Examiner on April 8, 2009, the objection to the drawings was discussed with Examiner Hunter. During the telephone interview, Examiner Hunter indicated that in one version of the digital copy of the application that was accessible to him, the Brief Description of the Drawings ended at the description of Figure 4, and that there was no brief description of Figures 5 through 13. After further review of a digital copy of the application on the Patent Office PAIR system, which includes the full text of page 7, Applicants assume that there must have been a scanning error introduced when the application was scanned by the Patent Office that deleted a portion of the Brief Description of the Drawings on page 7 of the application as translated. A complete copy of page 7 is visible in PAIR and available to the Examiner and includes the Brief Description of the Drawings for Figures 5 through 13. As such, Examiner Hunter indicated that the objection to the drawings and objection to the specification would be withdrawn upon this explanation and reference to the telephone interview of April 8, 2009. Applicant respectfully requests that the Examiner withdraw the objections.

35 U.S.C. § 112

The Office Action rejected the claims 28, 29, 41, and 42 under 35 U.S.C. § 112 first paragraph as failing to comply with the enablement requirement. The Office Action further indicated that the claims contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to make and/or use the invention and further indicated the claim term “higher orders of curvature not explained.” We note that the term “higher orders of curvature” does not occur in claim 29, but does occur in claim 27. As such, we assume that the Examiner’s reference to claim 28 and 29 was in error and that claims 27 and 28 were instead intended.

As explained in the application as published, in paragraph 0022, in refractive surgical procedures, it is often necessary to correct higher order aberrations by removing a volume of corneal stromal material from the cornea to create a cut surface that has a particular curvature. After these materials are removed, the remaining cut surface that is required for the purpose of correcting higher order aberrations then defines the claimed “higher orders of curvature.” It is well known to those of ordinary skill in the optical arts that higher order aberrations can occur in optical systems, including the human eye. For example, the Encyclopedia Britannica published in 1911 addresses this well known knowledge in the optical arts.

This Encyclopedia Britannica entry can be viewed on the internet at the url: http://en.wikisource3.org/wiki/1911_Encyclopedia_Britannica/aberration as well as at other websites.

Any optical surface that is not simply spherical has optical irregularities that create higher orders of aberration in light focused by the optical surface that may need to be corrected. A very simple example of a “higher order of curvature” is toricity of an optical surface that leads to astigmatism of any optical system, including the eye. Astigmatism is a very basic form of a higher order aberration. The correction for astigmatism uses a cylindrical or spherical cylindrical lens to compensate for the astigmatic aberration. That is a lens that has different radius of curvature in different planes or axes. Astigmatism is, of course, very common, and a very large fraction of people who use corrective lenses to correct for refractive errors require a correction for astigmatism to see well. These corrective lenses, whether in spectacles or contact lenses utilized higher orders of curvature to accomplish a sphero-cylindrical correction to compensate for astigmatism. Thus, “higher orders of curvature” of an optical surface is a well-known term to those of ordinary skill in the optical arts and should not require any additional explanation. Applicant respectfully requests that the Examiner withdraw the rejection.

Claim Rejections – 35 U.S.C. § 102

The Office Action rejected claims 20 through 29, 31, through 42, and 45 under 35 U.S.C. § 102b as being anticipated by Slinger et al. (6,325,792). By this amendment, applicant has amended independent claims 20 and 32 to recite that the first spatial direction is parallel to an axis along which the application of laser radiation is made. This is also commonly referred as the “z axis.” This amendment should assist in the understanding that the invention assists in fast cutting and surface generating by shifting the focus along contour lines of the cut surface, the contour lines being in planes substantially perpendicular to the first direction. The first direction

in this case is often referred to as the z direction. As such, applicants respectfully traverse the rejection.

The claimed invention addresses the problem of generating a cut surface as quickly as possible while using a method or apparatus which shifts the focus of a laser beam in a three dimensional fashion, in for example, laser refractive surgery. Typically, such a three dimensional focus shift is obtained by combining a two axis mirror scanner, which scans the laser in the x and y directions with an adjustable optical system for shifting the focus in the z direction which is generally the optical axis of the optical system. It is known to those of ordinary skill in the art that movable mirrors can be adjusted much more quickly than an optical focusing system, which adjusts focus relative to the z direction. Within the limitations of such an optical system, the invention provides for faster generating of a cut surface by shifting the position of the laser along contour lines of the cut surface. The contour lines are in planes which are substantially perpendicular to the first direction, which is the z direction. As such, the invention minimizes the need for adjustment of the slower focus shift along the optical axis of the laser application system. This expedites generation of the cut surface.

It is helpful to recognize that a contour line (which is also known as a level set, isopleth, isoline, or isogram) of a mathematical function of two variables is curve along which the function has a constant value.

This principle finds application in cartography, in particular, in topographic maps. In a topographic map depiction, a contour line (sometimes just called a contour) joins points on the map of equal elevation above a given level. In the example of a topographic map, contour lines are used to show hills, valleys and the steepness of slopes. In the claims of the present application, the meaning of contour line is the same as that used in topographic maps as applied to the surface being laser cut, such as the cornea in refractive surgical procedures. Thus, the contour lines as claimed are lines of the cut surface, which have an equal height and thus a substantially equal focal distance as measured from the optics through which the laser is applied. Thus in the language of claim 20, the invention includes “guiding the focal point such that it follows with respect to the two other spatial directions *contour lines of the cut*, the *contour lines being located in planes that are substantially perpendicular* to the first spatial direction.

The Office Action indicates that the Swinger reference anticipates the claimed invention. In the context of the Swinger disclosure, the first direction as claimed, according to the present invention corresponds to the optical axis of incitation of laser radiation, which coincides with the viewing axis. However, Swinger does not disclose or suggest anything relating to contour lines located on a plane perpendicular to the viewing axis. Further, Swinger does not disclose or suggest that the laser focus is guided along any contour lines. There is no mention in Swinger of either planes perpendicular to the optical axis or to contour lines. As such, the Swinger reference does not disclose or suggest all of the limitations of either claim 20 or claim 32. Therefore, independent claims 20 and 32 are patentable over the Swinger reference. Dependent claims 21 through 31 depend from claims 20. Dependent claims 33 through 46 depend from claim 32. These dependent claims should be patentable as well for at least the same reasons as the

independent claims from which they respectively depend. Applicants respectfully request that the Examiner withdraw the rejections.

35 U.S.C. § 103

The Office Action rejected claims 29, 30, 31, 43, 44, and 46 under 35 U.S.C. § 103(a) as being obvious over Swinger in view of Gerlach et al., (US 6,608,674). Applicant respectfully traverses the rejection.

First, as discussed above, Swinger does not disclose or suggest all of the limitations of independent claims 20 or 32. The Gerlach reference does not make up for the deficiencies of Swinger, therefore, claims 29, 30, 31, 43, 44, and 46 are patentable at least because of their dependency on patentable independent claims. Further, the invention as claimed is not obvious over the combination of Swinger and Gerlach because it provides the significant advantage of dramatically reducing the impact of the slow response of focusing optics in shifting the laser focus in the z direction as compared to the quicker x and y movement provided by mirror scanners. Thus, the invention, as claimed, advantageously accelerates the generating of cut surface over the prior art. This is particularly beneficial in the context of laser refractive surgery, where the eye of the patient may move, and has a greater tendency to move the longer the procedure lasts. The limitations in the independent claims as well as the concept of using contour lines simply does not appear in the prior art at all. Therefore, one of ordinary skill in the art would have no reason to modify any known device as shown in the prior art of record to arrive at the claimed invention. The element of guiding the laser focus in the x and y spatial

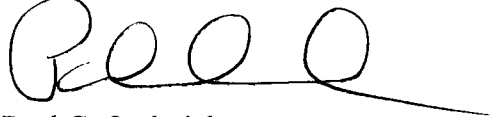
directions following contour lines of the cut, is not disclosed or suggested in the prior art.

Applicant respectfully requests that the Examiner withdraw the rejections.

In view of the foregoing, it is submitted that this application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully requested.

The Examiner is invited to telephone the undersigned if the Examiner believes it would be useful to advance prosecution.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'P. C. Onderick', with a long horizontal line extending to the right.

Paul C. Onderick
Registration No. 45,354

Customer No. 24113
Patterson, Thunte, Skaar & Christensen, P.A.
4800 IDS Center
80 South 8th Street
Minneapolis, Minnesota 55402-2100
Telephone: (612) 349-5766